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# Multi-scale mapping of cultural ecosystem services in a socio-ecological landscape: A case study of the international Wadden Sea Region

Frans J. Sijtsma · Nora Mehnen · Per Angelstam · José Muñoz-Rojas

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## Abstract

**Context** The governance of international natural World Heritage sites is extremely challenging. In the search for effective multilevel governance there is a need to identify the community of people which have place attachment to the areas, i.e. ‘the community of fans’ at local to international levels.

**Objectives** Focusing on the landscape of the international Wadden Sea coastal area in the Netherlands, Germany and Denmark as a case study, we address three key questions: What is the spatial distribution of the community of fans? How does the size of this community relate to the overlapping communities of locals and actual visitors to the Wadden Sea coastal area? Which parts of the Wadden Sea coastal area are most appreciated by the community of fans, and how does this relate to its formal protection status?

**Methods** We analysed 7650 respondents’ answers to a tri-lateral web survey (the standardized Greenmap-per survey) conducted in Denmark, Germany and the Netherlands.

**Results** We estimated that 14 million German, Dutch and Danish citizens can be regarded as the potential—national level—community of fans. The correlation between place or landscape attachment and distance was varied among the three countries. Furthermore, only 37% of the markers placed by fans of the Wadden Sea coastal area are within the protected UNESCO World Heritage limits, suggesting that a broader demarcation could be possible.

**Conclusions** We discuss how the identification of fans can potentially contribute to more effective public involvement in the governance of valuable landscapes.

**Keywords** Nature attractiveness · UNESCO Natural World Heritage · Participatory GIS · The Netherlands · Germany · Denmark · Multiscale measurement · Value mapping

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## Introduction

Governance of protected areas is the active combination of mechanisms of coordination and network structures for management and decision making; involving different actors from the state, civil society

and economic sectors (Ansell and Gash 2008; Mehnen 2013; Chaffin et al. 2014). The governance of international World Heritage sites is particularly challenging (Graham et al. 2003; Hughes et al. 2007). Natural World Heritage sites involve local communities like any other protected area, but because they also explicitly involve the global community, they seem to be among the most demanding cases of multilevel governance. The governance literature clearly shows the complexity arising when different institutions and stakeholders with different interests and perceptions have their say (Stoll-Kleemann and Welp 2006; Benz and Dose 2010; Klinke 2012). However, the literature also shows that involving the main stakeholders in governance processes of protected areas is essential to democratic governance (Lockwood et al. 2010; Klinke 2012; Mehnen 2013).

In the continuing discussion of the governance of natural resources and protected areas (Angelstam and Elbakidze 2017), the need for governance institutions operating from local to international levels is thus indisputable (Berkes et al. 2006). Yet, in regard to the *how* of multilevel governance, there is no simple blueprint (Ostrom 2007). Berkes (2007) identifies two key players in the debate and practice of conservation of biodiversity and wildlife, the state and the local community. While earlier the state predominated as key actor in more recent years the local community tends to dominate governance debates (Berkes 2007). Barrett et al. (2001, p. 497) observed, when discussing tropical conservation, that “community-based natural resource management overemphasizes the place of local communities (...), much as the previous top-down model underemphasized [it]”. They argue that the scale at which both the ecological and social process function around a particular protected site “typically far exceeds the space any single [local] community can ably manage” (p. 497). Community-based conservation therefore seems powerful, but the strong focus on the local scale limits its potential.

Ostrom (2007) emphasised that a strengthening of multilevel governance needs to build on attachment to place. Various approaches and definitions of place attachment can be found (Lewicka 2011) but broadly speaking place attachment refers to ‘the positive emotional bonds that develop between individuals and their environment’ (Brown and Raymond 2007, p. 90). People in our current globalized world develop place attachment to protected areas and landscapes

across a wide range of spatial scales, from local to global (Lewicka 2011; de Vries et al. 2013; Bijker and Sijtsma 2017). An increasingly spatially complex reality begins to form, in which individual citizens are linked to a portfolio of places and landscapes that bear multiple natural and cultural values (Bijker and Sijtsma 2017).

Vanclay (2012) argues that day trippers and holidaymakers who feel attracted to unique or singular landscapes are likely to develop a strong attachment to such places: “when landscapes and/or regions are significant biodiversity reserves, World Heritage sites or have significant cultural heritage values, or are highly socially valued for some other characteristic, many individuals may develop strong custodianship or stewardship notions over them, albeit vicarious, and feel they are a legitimate stakeholder in decision making about a specific location or landscape, even if they don’t live there and sometimes even if they have never actually been there” (Vanclay 2012, p. 149).

Recent findings from the psychology of landscape and nature experiences strengthen the point that the relation between visiting and developing feelings of place attachment may be far from simple. This literature finds that experiences of strong and deep emotions may occur in varied, wild or remote landscapes bearing very intensive natural values, but such strong emotions also occur only infrequently (Davis et al. 2016). These peak experiences may, however, be the ones people cherish most often, and as such define their place attachment strongly (Williams and Harvey 2001; Heintzman 2009). This highlights the relevance of involving both visitors *and* people who have developed substantial feelings of attachment towards the landscape, including those whom may have never visited such places, or only rarely visit them. Broadening the spectrum of locals with place attachment to (regular) visitors (with place attachment) as key stakeholders is logical for a protected area with touristic attractiveness, but including also rare visitors (or sometimes even non-visitors) with strong place attachment is also crucial (Vanclay 2012). A place attachment focused approach to governance also assures that individual consumer values are complemented with caring stewardship values (Liburd and Becken 2017).

We see the need for a broader concept that goes beyond both the local community and the mere consumptive stance of visitors but remains true to

place attachment, namely to identify the ‘community of fans’ of a particular area or region. The community of fans is that group of people who value and appreciate a given landscape. Such a community of fans may be a useful stakeholder group in an effective multilevel governance framework (c.f., Obst et al. 2002; Hinck 2015; Price 2017). Fans include locals, visitors and other people with genuine attachment and positive connection to a specific protected place or landscape. The community of fans, due to its personal connection to the area, is quite unlike the more formal position of institutions as, for instance, the state or the EU acting as regulator or legislator as well as it is markedly different from the general ‘global community’ of, for instance, environmental NGOs. The position of fans could be quite similar to the position of ‘stewardship alliances’ in governance in accordance with Liburd and Becken (2017), who state that “formal governance arrangements at UNESCO World Heritage sites are often complemented by stewardship” and that stewardship alliances commonly function “across local, national and international levels” (p. 6).

Empirical measurement of people’s attachment to landscapes has made strong progress in recent years. Brown et al. (2014) Brown and Kyttä (2014) and Kyttä (2011) discuss the development of new technologies involving public participation GIS (PPGIS) and participatory GIS (PGIS). These technologies include a SoftGIS method or related crowd-sourcing techniques for mapping the cultural and natural values that are assigned to places or landscapes. Kahila and Kyttä (2009) assert “that new technology, and especially web-based GIS applications, can become an important way of facilitating communication between local inhabitants and planners” (Kahila and Kyttä 2009, p. 390). Brown and Fagerholm (2015) point out that spatially explicit methods have evolved over the past decade and are increasingly useful to help identify a range of ecosystem services, especially cultural ones (Chan et al. 2012). Following these developments, in this paper we will make use of a web-based GIS application which can identify cultural ecosystem services (de Vries et al. 2013; Bijker and Sijtsma 2017). However, from a multilevel governance perspective there is an active search for effective *multi-scale* methods to measure and map the everyday reality of nature and landscape appreciation (Bronzizio et al. 2009; Angelstam et al. 2013; Cumming et al. 2015). Brown and Fagerholm (2015) see the field

is currently dominated by methodological pluralism and found little proof of actual use of the data. In this paper we will argue for, and empirically use, a more standardized *and* multi-scalar way of measuring landscape appreciation, which may enhance the wider applicability and use of this type of data.

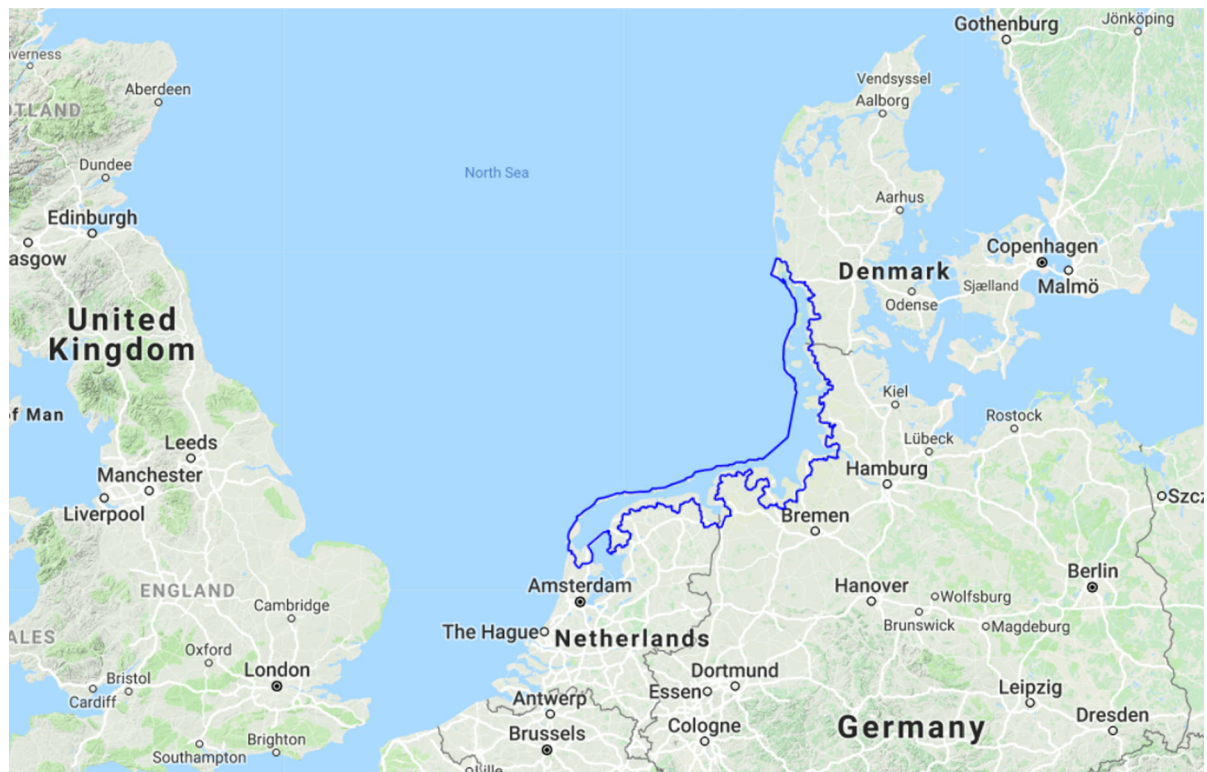
A key aspect related to the change in perspective from a *local community* to a *community of fans* is the shift that takes place in the spatial focus adopted in the analysis of landscapes. Wu and Qi (2000, p. 1) address the importance of spatial scales for landscape ecology “because a landscape usually is composed of smaller ‘landscapes nested in larger landscapes’ (...) scale and hierarchy are inevitably related in landscape ecological studies.” In this paper we will show that the multi-scalar nesting of landscapes is also relevant and powerful when mapping the landscape of the community of fans.

The aim of this study is to contribute to the debate on how to improve multilevel governance of protected areas and landscapes by identifying and quantifying the community of fans of a single protected area. Focusing on the Wadden Sea coastal area as a case study we used an online PGIS tool called Greenmapper (previously known as Hotspotmonitor; see de Vries et al. 2013) to address the following three key questions:

- (1) What is the spatial distribution of the community of fans?
- (2) How does the size of this community relate to the overlapping communities of locals and visitors of the Wadden Sea Coastal Region?
- (3) Which parts of the Wadden Sea coastal area are most appreciated by the community of fans, and how does this relate to the formal protection status?

### Case study area

The Wadden Sea coastal area is an international coastal region along the European North Sea coast that spans the Netherlands, Germany and Denmark (see Fig. 1). Concretely, it stretches from Den Helder in the Netherlands, along the North Sea coast of Germany, to Esbjerg in Denmark, with a total length of roughly 500 km, and total area of about 10,000 km<sup>2</sup> (Kabat et al. 2012). A significant proportion of the Wadden Sea coastal area is protected because of the high nature



**Fig. 1** The Wadden Sea Region. Source [www.walterwaddenmonitor.org](http://www.walterwaddenmonitor.org)

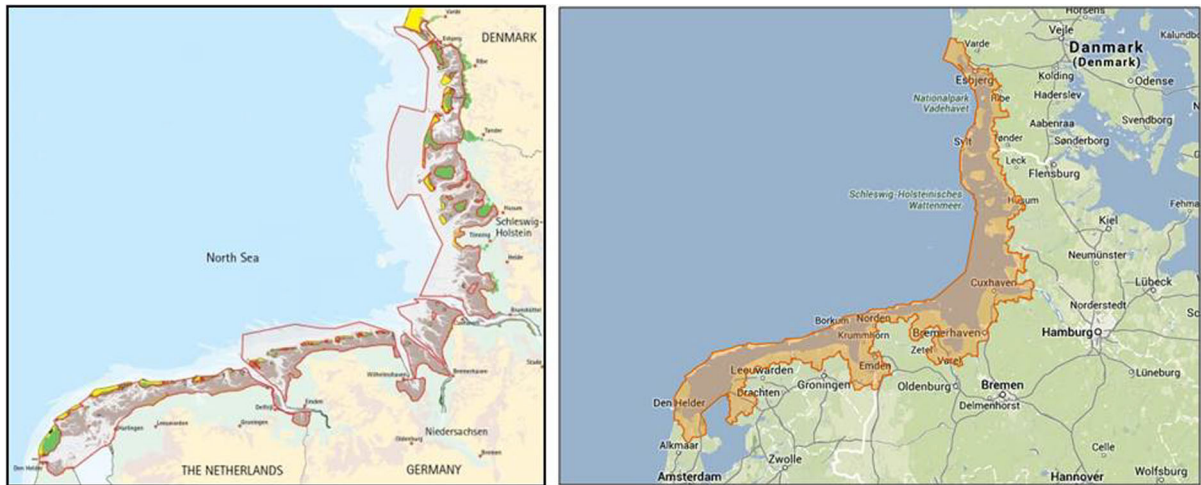
values it fosters along its shallow body of water with islands, tidal flats and wetlands. The Wadden area provides a habitat for many species, particularly for seals and for many (protected) species of birds during breeding, migration and winter seasons (Wolff 2013). In regard to its socio-economic situation, the region is mainly rural, but some parts of the Wadden in the Netherlands and Germany correspond to the hinterlands of medium-sized or small urban areas (OECD 2012). Economic activities in the region include fisheries, transport, industrial activity, and gas extraction. The Wadden Sea coastal area is also an important tourist destination (Sijtsma et al. 2012). Having been intensively used and shaped by humans, it now forms a socio-ecological system (Young et al. 2006). The governance of this system is under constant debate (Van der Molen et al. 2016; Slob et al. 2016) with regard to the impacts on its sustainability and resilience (Turnhout et al. 2008; Kabat et al. 2012). The borders of the Wadden area differ strongly depending on whether one takes an ecological perspective (with the accompanying protected areas through Natura 2000, Ramsar, UNESCO, IUCN,

etc.) or a socio-economic perspective (Sijtsma et al. 2014; Wadden Sea Forum, WSF 2015). Figure 2 shows the two relevant borders in this paper, one socio-economic and one ecological. The socio-economic perspective abides by administrative borders at their lowest levels: municipalities in Germany and the Netherlands, and parishes in Denmark (Sijtsma et al. 2014). Whereas from an ecological designated area perspective, we focus on the UNESCO World Heritage site boundaries. These limits were established across all three countries officially in 2014. By June of 2009, the Dutch and German options of the Wadden Sea coastal area had been added to the UNESCO World Natural Heritage list, preceded by extensive discussions (Van der Aa et al. 2004), while in 2014 the nomination of the Danish part of the Wadden Sea was also accepted on the UNESCO list.

## Methods

In order to identify the fans of the Wadden Sea Coastal Region, we used version 2.0 of the Greenmapper





**Fig. 2** Two distinct spatial definitions of the international Wadden Sea Region: the ecological and UNESCO protected or designated area perspective (*Source* Common Wadden Sea Secretariat, CWSS, 2012) is shown on the left, and the (coastal) regional perspective appears on the right ([www.walterwaddenmonitoring.org](http://www.walterwaddenmonitoring.org)). It may furthermore be noted

that the World Heritage definitions only for the Danish and German parts include shallow areas of the North Sea area, while in the Netherlands the (land of the) Wadden Islands is excluded. The regional area definition on the right side of includes more land mass, especially coastal land

survey tool that was designed to identify valuable nature-related places (Sijtsma et al. 2012; De Vries et al. 2013; Bijker and Sijtsma 2017, [www.greenmapper.org](http://www.greenmapper.org)). The central Greenmapper questions asked *Which places do you find very attractive, valuable or important? And why?* Respondents were instructed to mark places limited to those with green space, water or nature. Respondents marked these places in a Google maps supported software environment, using the satellite view as a default and their home address as a reference point to facilitate their orientation across the map. Respondents were asked to identify their approximate home location first, and then mark attractive nature-related places across different spatial scales: local (within 2 km of their home), regional (within 20 km of their home), national and global. In this paper we mainly consider the places that were marked at the national and international/global levels.<sup>1</sup> After identifying a place of high value at national or global level, more detailed sets of information were requested, including what mark on a 1–10 (worst–best) scale would they grant each chosen place, why they find each place attractive (open answer question), how often they visit them (predefined

categories), and if they visit the place which (predefined) activities they undertake while being there (De Vries et al. 2013; Sijtsma et al. 2014; Bijker and Sijtsma 2017).

We then used the answers to the Greenmapper questions as an operational tool for identifying the community of fans. The respondents who answered the question at the national level, while having the ability to choose from any nature-related place in the whole country and yet marked the Wadden area as an attractive valuable area, were considered as Wadden Sea coastal area fans. The same applied for those who marked the Wadden Sea coastal area at the international level while having the option to choose a nature-related area anywhere in the world. In order to estimate the total number of fans for the Wadden Sea coastal area in the overall population of the three countries, we calculated the percentage scores of the sample per administrative region and country and applied it to their respective population totals. These numbers were summed to obtain the national and overall total figures. In regard to the regional divisions, we used in the Netherlands the 12 provinces (NUTS 2), in Germany the 16 Bundesländer (NUTS 1), and in Denmark the 5 regions (NUTS 2).

The present study employs the GfK Company (<http://www.gfk.com>): a market research bureau

<sup>1</sup> Only for the inhabitants of the Wadden Sea Region will we use all four levels. Available data can be seen at <http://data.greenmapper.org>.

which provides global internet panel services (Sijtsma et al. 2014). Member of the GfK Panel were asked to fill in the Greenmapper survey (2.0). The respondents approached by GfK were intended to represent the whole populations of the regions of all three countries under consideration (Sijtsma et al. 2014; Bijker and Sijtsma 2017). The data for this paper were gathered in the summer of 2013 (see Sijtsma et al. 2014; Bijker and Sijtsma 2017 for more details). GfK can generally deliver completely representative sets of respondents for the three countries (at the country level), but our research had a strong spatial focus. It aimed for respondents to be spatially evenly spread across the three countries. Respondents were therefore equally spread across each region in each country: about 1/12 from every 1 of the 12 Dutch provinces, 1/16 from every 1 of the 16 German Bundesländer, and 1/5 from every 1 of the 5 Danish regions. In each area we aimed for 50% of the respondents living in the capital city, while the other 50% resided elsewhere in the regions. In the search for a target in the total number of participants, a balance was sought between a minimum threshold of respondents per country (set at 1000), a reflection of the size of the overall population of all three countries, and the available research budget, while also aiming to assure a robust spatial representation. All in all, we obtained 7656 responses, 1316 of which were from the Netherlands, 5275 from Germany, and 1065 from Denmark. Respondents were sought by GfK using the equal spread across the regions in all three countries; as explained above. Figure 3 depicts the home locations of the participants across the three countries. Splitting the sample geographically across regions and having only limited numbers of respondents in every spatially distinct part does naturally cause some loss of general representativeness.

Table 1 shows the resulting composition of the respondents as to gender and age and compares it to the 2014 population in the three countries. There was no loss of gender representativeness, and a remaining wide spread among different age classes, but an underrepresentation of younger and older aged. When GfK sent out requests to its members, the overall response was monitored per country (not per region) until the quota of respondents were reached. Exact numbers on the response rate were not given by GfK but they informed us that generally they have a 70% response rate on their regular simple question–answer

surveys, while they estimated a 50% response rate here due to linking to an unfamiliar survey context outside their GfK software environment and the more demanding technique of asking through placing markers on map.

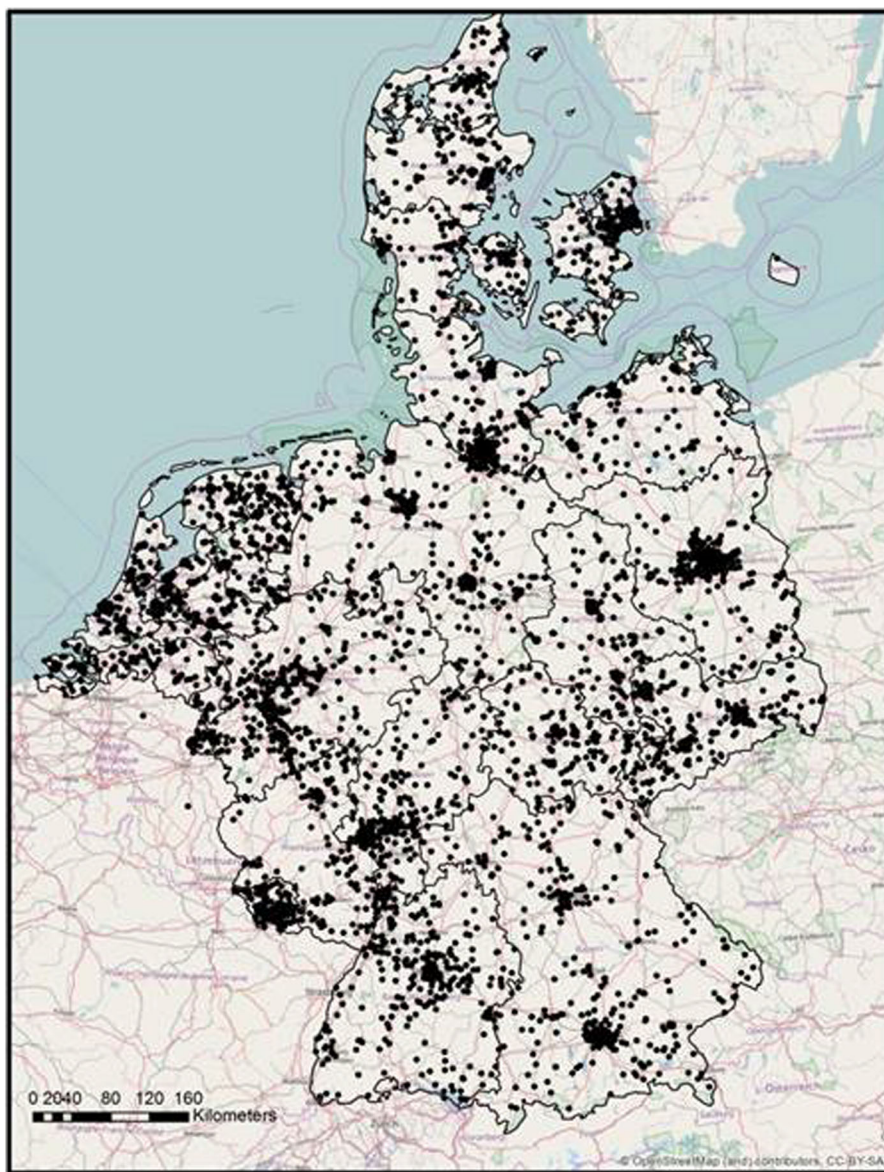
To identify statistically significant spatial areas of attractiveness we clustered all point markers. To achieve this, and following the procedure described by De Vries et al. (2013) and Daams et al. (2016), we employed Arc-GIS to create clusters of attractive places for each of the national markers around a number of three (or more) points within a selected aggregation distance of 5 km.

## Results

### Q1 What is the spatial distribution of the community of fans?

To assess the spatial distribution of the community of fans, we started at the national scale of appreciation and used the broader definition of the Wadden Sea coastal area (see right side of Fig. 2). We measured the percentage of respondents in all 12 provinces in the Netherlands, all 16 Länder in Germany and all 5 regions in Denmark that placed their markers within the Wadden Sea coastal area. A clear spatial pattern was detected in the results on perceived landscape attractiveness (Fig. 4). The percentage of respondents that marked the area as ‘a very attractive and valuable national place’ was relatively high in regions near the Wadden area. It was highest in the Dutch Province of Fryslân (33%) and in the German Bremen, where this proportion exceeded 50% (Fig. 4). We also detected that, in general, the level of appreciation decreased the farther away respondents lived from the region. However, when viewed across all three countries and regions, significantly different patterns among each of these could be observed. We noticed in particular that the appreciation of Wadden coastal landscapes in Germany was much stronger throughout the whole country than in either the Netherlands or Denmark (Fig. 4). In Germany robust levels of appreciation were found in North Rhine-Westphalia (18.6%) and Rheinland-Pfalz (16.7%). Even in Saarland, approximately 500 km away from the Wadden area, 15.6% of respondents still chose the Wadden as a highly attractive landscape. This finding was a higher

**Fig. 3** Home locations of all 7500 participants in the survey (points may overlap)



percentage than, for instance, in Overijssel in the Netherlands (13.6%), which is much closer at about 100 km from the Wadden coastal area. In Denmark the distance decay rate was even higher than that of the Netherlands.

We then analysed the results obtained for the global level of appreciation of the Wadden Sea coastal area. The percentage of people marking the Wadden region while being able to choose *any* attractive, valuable or important landscape *in the world* was, logically, much lower than on the previous map. Respondents would now mark many other places in Europe and also across

the globe. For instance (see Fig. 5) they marked the Grand Canyon in the USA, the Great Barrier Reef and New Zealand, and the coasts of Portugal and Spain, including the Island of Mallorca, to mention just a few highlights. However, even within the global scope, the Wadden region was still marked to some extent (see Fig. 5, upper left). The same differences in distance-based appreciation decay among the three countries was also evident on the final world level map obtained (Fig. 6). Once again, this attractiveness proved to be stronger at greater distances in Germany than in the Netherlands and Denmark. While in several regions of



**Table 1** Comparison of gender and age of respondents of the Greenmapper survey and the population of the three countries (Eurostat 2014)

	Germany		Denmark		Netherlands	
	Respondents Greenmapper	Population Eurostat	Respondents Greenmapper	Population Eurostat	Respondents Greenmapper	Population Eurostat
Gender						
Female	49%	49%	50%	50%	51%	50%
Male	51%	51%	50%	50%	49%	50%
Age categories <sup>a</sup>						
16–20	3%	6%	2%	8%	2%	8%
21–25	10%	7%	5%	8%	7%	8%
26–30	14%	8%	5%	8%	8%	8%
31–35	12%	8%	6%	7%	8%	8%
36–40	10%	7%	6%	8%	9%	8%
41–45	13%	8%	10%	9%	10%	9%
46–50	11%	10%	16%	10%	10%	10%
51–55	10%	10%	11%	9%	9%	9%
56–60	7%	9%	13%	8%	12%	9%
61–65	5%	8%	15%	8%	10%	8%
66–70	2%	6%	7%	8%	10%	7%
71–75	1%	7%	3%	6%	5%	5%
76–80	0%	6%	1%	4%	1%	4%
Total	5275	65,758,671	1065	4,423,674	1316	13,262,126

<sup>a</sup>Eurostat 5-year categories differ 1 year: 15–19, 20–24, 25–29, etc.

the Netherlands, and also in Denmark the percentage of respondents marking the Wadden as their internationally attractive place was zero, we found that this was not the case for Germany. The percentage was positive across all the regions of Germany; even in Bundesland Bayern, located in the opposite corner of Germany, the area was designated by 2% of the respondents.

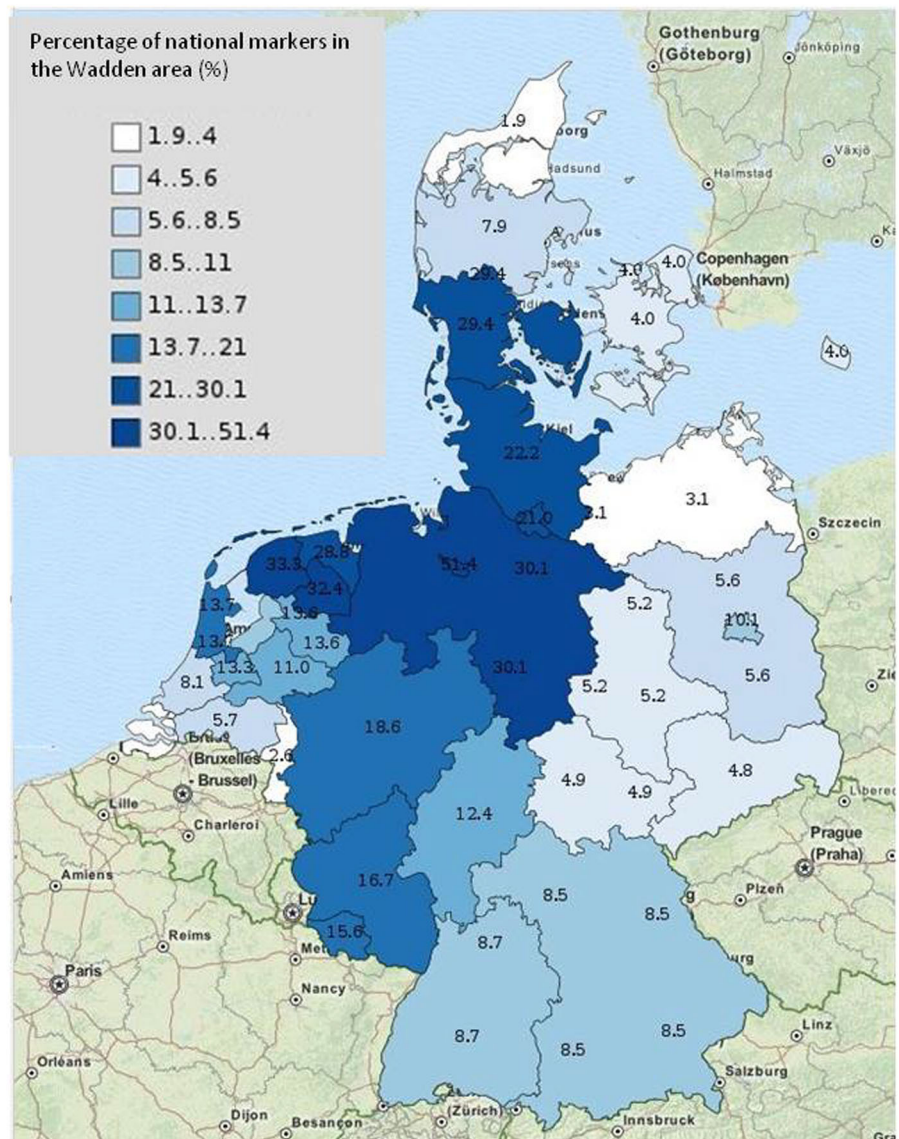
**Q2** How does the size of this community relate to the overlapping communities of locals and visitors of the Wadden Sea Coastal Region?

Based on the results of the national attractiveness survey for the Wadden Sea coastal area (shown in Fig. 4), we estimated the total number of Dutch, German and Danish appreciating fans of the Wadden coastal area to be 14 million people (Fig. 7). Of these, the Netherlands hosted approximately 2 million fans, Germany > 11 million, and Denmark around 0.5

million. In effect, of the total number of fans 14% were Dutch, 82% German and 4% Danish. We also estimated that there are 14 times more appreciating Wadden fans than Wadden inhabitants. The ratio of the number of Wadden fans to the number of inhabitants of the Wadden area in the Netherlands (f: 1,951,000, i: 267,000) and Denmark (f: 529,000, i: 80,000) is around 7, while in Germany (f: 11,301,000, i: 662,000) it is higher: 17.

In relation to the Wadden, we can also estimate and define fans on the basis of the results on global attractiveness (Fig. 7; based on Fig. 6), which may in future researches allow an assessment of the number of global fans in countries other than the three considered here (see Discussion for Swiss and Italian estimates). We estimated the total number of Dutch, German and Danish appreciating fans of the Wadden coastal area at the global level, marking the Wadden while they could choose from *any* natural place around the world, to be 3 million people. Of these, the

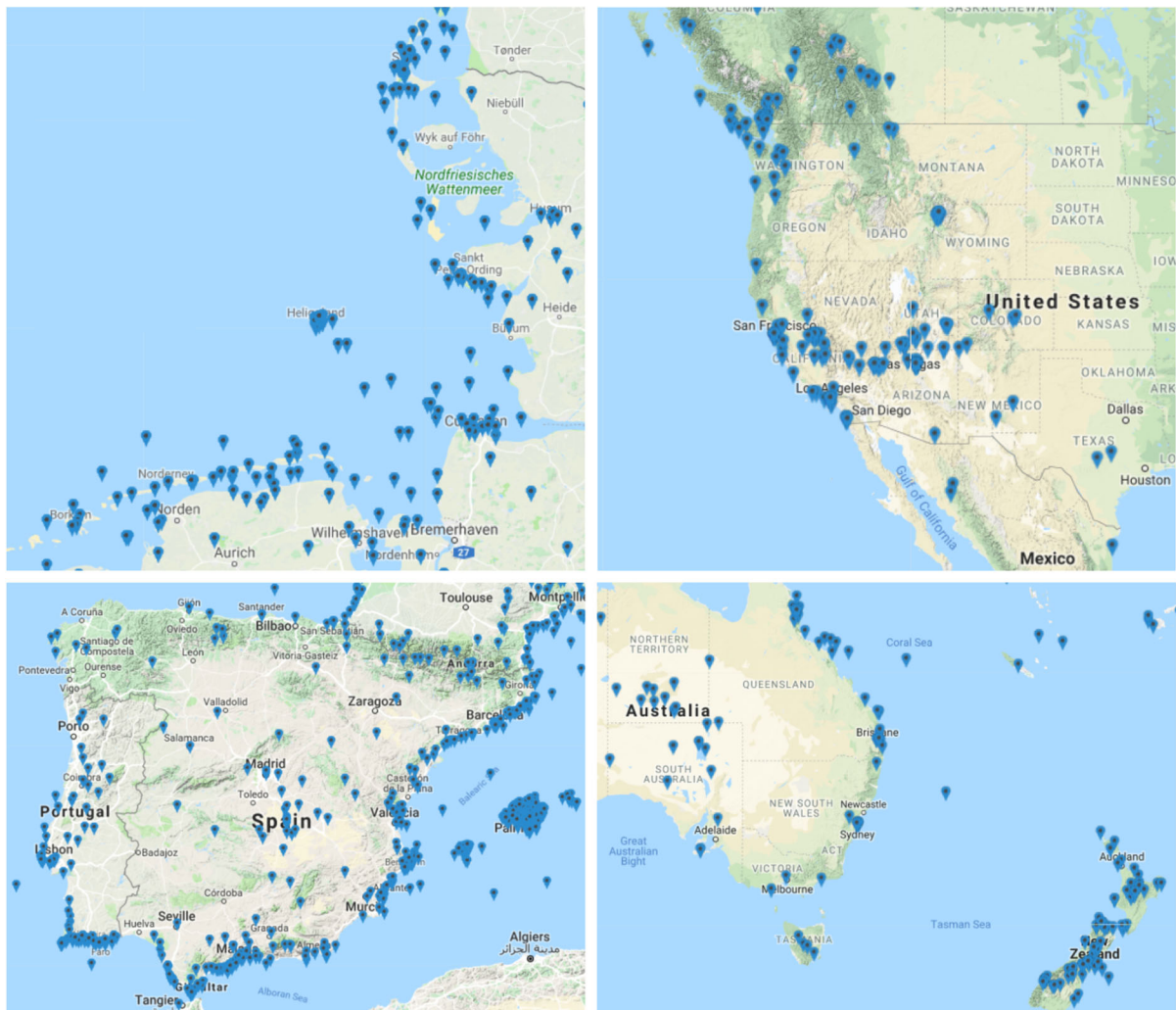
**Fig. 4** Percentages of Wadden Sea markers (national level) by Bundesland (DE), Region (DK) and Province (NL)



Netherlands hosted some 0.16 million fans, Germany 2.70 million, and Denmark around 0.11 million.

Using data on visiting frequencies we may also assess the relationship between the fans compared to their constituent groups of local fans, regular visitors, and rare or non-visitors, and assess indicators of the strength of the place attachment of these groups. Table 2 shows key numbers assessing indicators of perceived attractiveness/place attachment indicators. We used only quantitative indicators from the questions with predefined answers and no text analysis of the open answer question on the attractiveness. This was beyond the scope of this paper, but we did

calculate the *number of words* used to describe the attractiveness (for text analyses see [Sijtsma et al. 2012](#); [Davis et al. 2016](#)). The resulting Table 2 has three sections, the upper section indicates results for (n = 1021) Wadden Sea coastal area fans at the national level, the middle section shows results for the (n = 200) world level fans, while the lower part gives results for the locals: the people living in the Wadden Sea coastal area. The upper and middle sections provide, per visiting frequency category indicators of place attachment and perceived attractiveness: the average grade given for the marked place; the number of recreational activities respondents say



**Fig. 5** Global markers placed by the respondents in four sample areas. (1) Upper Left: German sections of the Wadden. Upper right: eastern part of USA. Lower left: Iberian Peninsula. Lower right: Australia and New Zealand. Source [www.greenmapper.org](http://www.greenmapper.org)

they undertake when visiting; the number of words used to describe the attractiveness or value of the marked place. Finally the distance between home location and marked place is given per visiting frequency category.

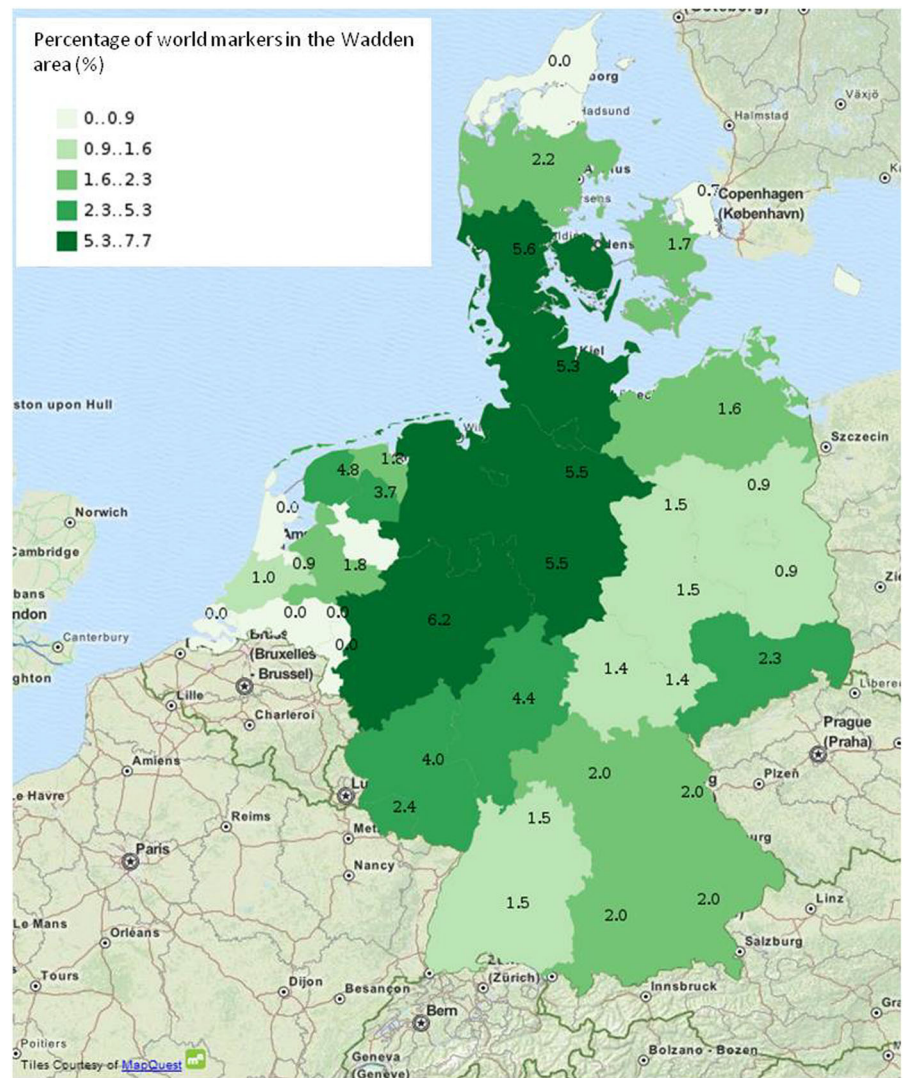
Table 2 sheds light on the distinction between visiting fans and non-visiting or rarely visiting fans. Distance is the most straightforward factor: the farther away one lives, the lower the visiting frequency to the place. The categories ‘rarely’ and ‘never’ are hardest to associate with visitors: they are fans but they rarely or never go there. Fans at the national levels comprise over 31% of this type; but at the global level they represent 41%. When we examine the grades given to

the marked place (1–10 option), one may see that higher visiting frequencies (monthly and a few times per year) generally do lead to higher grading than lower frequencies. Although the category ‘rarely’ gives only slightly lower scores, the ‘never’ category is substantially lower, especially at the national level. The number of activities and the number of words used to describe the attractiveness of the places seem to show a somewhat similar pattern at both levels, but less strongly. When taken altogether, the indicators seem to suggest a quite slow gradient of lessening place attachment as visiting frequency falls.

Table 2 also shows the markers of locals living in the Wadden Sea coastal area which they also happen to



**Fig. 6** Percentages of Wadden Sea markers (international level) by Bundesland (DE), Region (DK) and Province (NL)



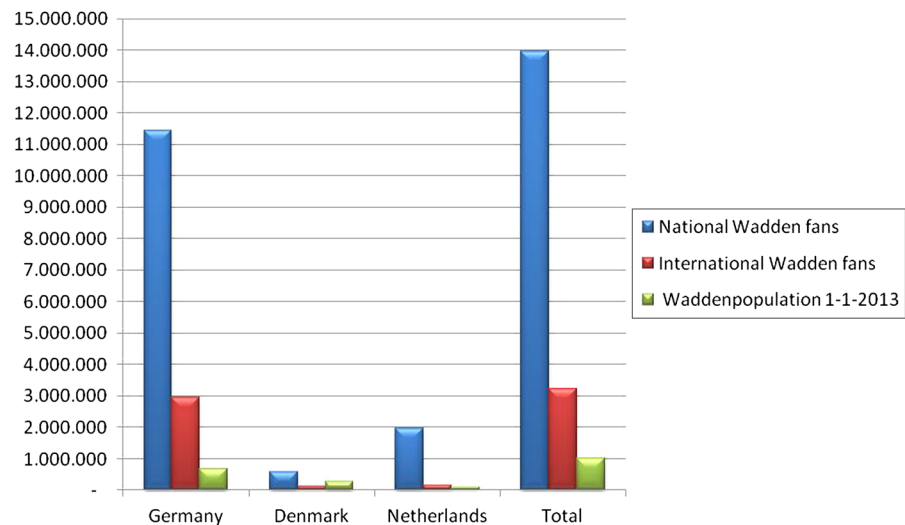
highly appreciate. Distance metrics once again follow a straightforward pattern. Neighborhood and regional markers are obviously often placed in the Wadden Sea coastal area, since they are by the design of the Greenmapper survey, marked within 2 km or 20 km from the locals' home location. So only respondents at the borders of the area can place their neighborhood and regional marker outside the Wadden Sea Coastal Region. The data (not presented in the table) show that of all the respondents living in the Wadden Sea Coastal Region, 89% placed their local markers (< 2 km from home) in the Wadden area, 91% placed their regional markers (< 20 km from home) in the area, while still 34% of the national markers was

placed in the Wadden Sea Coastal Region, and 8% of the global markers was placed there.

Table 2 shows that if locals also place their national or world marker in the area, their grading increases (as per the common pattern; see Bijker and Sijtsma 2017). The number of activities seems to increase with the level of attractiveness while the number of words used to describe the attractiveness, not the strongest of place attachment indicators without a serious content analysis of the meaning of the words, does not show a distinct pattern.



**Fig. 7** The estimated number of appreciating fans of the Wadden Sea Region, based on Greenmapper markers placed at both a national scale and international scale. Results are shown for each of the different countries and for the complete Wadden coastal region, relative to the inhabitant population of whole region



Q3 Which parts of the Wadden Sea coastal area are most appreciated by the community of fans and how does this relate to the formal protection status?

The Wadden Sea coastal area was found to be perceived as a significant hotspot of attractiveness to nature across all three countries surveyed (Fig. 8, left-hand side). Yet, at the finest spatial scale, and using cluster analysis to identify significant hotspots of landscape attractiveness within the Wadden region (Fig. 8, right-hand side), clear differences were obtained. Respondents across every country and region marked the Wadden Islands as attractive landscape spots, but strong differences were found in the attractiveness of the non-island landscapes of the region. On the Dutch mainland coast there was only one cluster of attractiveness marked: the wetland and Lake Area of the Lauwerslake (Dutch: Lauwersmeer). Likewise, the mainland coast in Schleswig–Holstein and Denmark were poorly appreciated, and only a few very small clusters were shown. In sharp contrast, however, the German coast in Lower Saxony contained many highly appreciated clustered hotspots of landscape appreciation.

Focusing on the overall borders of the Wadden coastal region, only 37% of the markers were placed within the protected UNESCO World Heritage limits (Table 3). In the Netherlands, only 23% of Dutch national markers were placed within the limits of the UNESCO World Heritage area; this number was 31%

for Denmark. In Germany, the UNESCO zoning seems to have been designated more in accordance with social preferences, with 42% of spatial coincidence between social appreciation and actual administrative borders. Nevertheless, the result still implies that 58% of the German Wadden markers were placed outside of the UNESCO demarcation.

## Discussion

### Fans, visitors and locals

We estimated that the community of Wadden Sea coastal area fans is 14 times larger than the number of actual Wadden inhabitants. In the Netherlands and Denmark, the ratio of fans to inhabitants was 7 to 1, while in Germany it was higher (17 to 1). This clearly demonstrates the potential that an approach focusing on people who declare their attachment to a protected area and landscape may have for improving multi-level governance. Vanclay (2012) asserts that visitors and holidaymakers may feel they are legitimate stakeholders “sometimes even if they have never actually been there.” This latter category seems to be limited with regard to the Wadden region: only 2–5% of the fans stated never to have been there. However, the ‘rarely visiting’ category is substantial (29–36%). Thus, Vanclay’s general point, namely that people may feel involved with a landscape with perhaps little

**Table 2** Place attachment indicators for the community of fans per visiting frequency category

	Absolute	Percentage	Grade	# of activities	# of words open answers	Distance home to marker (km)
National level fans (local, regularly visiting, and rarely visiting fans)						
Daily	5	0	6.7	9	16	63
Weekly	8	1	8.4	5	5	29
Monthly	49	5	9.0	7	8	155
A few times a year	256	25	8.8	6	5	166
Yearly	385	38	8.5	5	5	260
Rarely	297	29	8.3	5	5	299
Never	21	2	6.0	4	2	371
Nr of markers total	1021	100				
World level fans (local, regularly visiting, and rarely visiting fans)						
Daily	0	0				
Weekly	1	1	9.0	1	3	8
Monthly	5	3	8.2	3	7	40
A few times a year	51	26	8.9	6	5	231
Yearly	63	32	8.9	6	5	329
Rarely	71	36	7.9	4	4	326
Never	9	5	7.3	5	8	446
Nr of markers total	200	100				
Local fans: markers in the Wadden area from people living in the Wadden area (national and world level markers below were included in the numbers above)						
	# of markers					
Neighbourhood level	140	45	7.6	3	7	1
Regional level	123	39	8.4	4	7	9
National level	42	13	8.7	6	7	36
World level	8	3	8.9	5	5	69
Nr of markers total	313	100				

or no correlation with actual visits, is supported by our results.

#### A multilevel approach to fans

A key aspect of the shift in perspective from visitors-only to including also fans is the clear widening of spatial focus. A multi-scale perspective is crucial not only with regard to ecosystems, as Wu and Qi (2000) argue, but also with respect to the social dimensions of a landscape or socio-ecological system. Wu and Qi (2000, p. 1) have discussed “landscapes nested in larger landscapes”, while we argue that the multi-scale nesting of landscapes is relevant when mapping what could be called the ‘landscape of fan-appreciation’. Mapping fan-appreciation has helped to broaden the

ecologically-focused protected area borders of the Wadden to encompass a wider landscape. Nested within the Wadden Sea coastal area itself we found distinct clusters of attractiveness (right side of Fig. 8). Furthermore, our results show the power of mapping the fan community in relation to their home locations and the distance to the target study area. As with ecological studies, where for instance migratory bird behaviour cannot be understood by studying merely one location within their travelling route (Barrett et al. 2001, p. 497), the community of fans of the Wadden also cannot be understood without taking into account their home locations and living environment.

The research discussed here (performed in 2013) encompasses only the countries of the Netherlands, Germany and Denmark, where the Wadden Sea



**Fig. 8** Maps of expressed appreciation at the national and Wadden Sea Region levels. The left side of the figure shows attractive nature places on the national level, as marked by

German, Dutch and Danish participants. On the right side, attractiveness-clusters of national markers are depicted for the whole region

**Table 3** Number of markers in the broader international Wadden Sea coastal area (right side of Fig. 2) and the protected UNESCO area (left side of Fig. 2)

Country	Broader Wadden region (total number of national markers)	Protected UNESCO area (total number of national markers)	Proportion protected UNESCO area markers as % of broader Wadden region markers
NL	190	43	23
DE	666	281	42
DK	86	27	31
Total	942	351	37

coastal area is physically part of and found 3 million fans at the global level. However, the global level community of fans of this *World Heritage* will most probably not be limited to these three countries alone. In 2016, we performed two other studies using the standardised Greenmapper software: one in Switzerland (with online panel company [www.bilendi.de](http://www.bilendi.de) involving 1009 respondents), and one in Italy (with the online panel company [www.opinioni.net](http://www.opinioni.net) involving 1313 respondents). Here is not the place to give full results of this research because the Wadden was not the focus. Nevertheless, [data.greenmapper.org](http://data.greenmapper.org) does show important data which give illustrative insights from a global fan community perspective. Table 4 depicts the relevant data for estimating the potential size of the fan community in Switzerland and Italy, following exactly the same procedure as the calculation for the global level community in the Netherlands,

Germany and Denmark in Fig. 6. For sure the numbers are very low to claim robust estimates, but the percentage of people marking the Wadden do show a consistent distance decay pattern with 0.69% in Switzerland and 0.15% in Italy; smoothly following up on the 1.5–2% range in the southern parts of Germany. These merely illustrative estimates suggest that 60,000 Swiss fans and 90,000 Italian fans may potentially be added to the global Wadden Sea coastal area community of fans, but they primarily show the consistent working of fan-identification across scales.

#### Value mapping and standardisation

Our results exemplify the strong potential of online value mapping techniques (Brown and Kyttä 2014). We have shown that the Greenmapper-based survey can be used effectively to identify highly valued places

**Table 4** Indicative estimates of Swiss and Italian fans of the Wadden Sea coastal area

	Internet panel company	Wadden markers	Total world level marker respondents	Percentage world markers in Wadden	2016 Population (Eurostat)	Estimated number of fans in respective countries	Rounded estimated number of fans in respective countries (000)
Switzerland	<a href="http://www.bilendi.de">www.bilendi.de</a>	7	1009	0.69	8,327,126	57,770	60
Italy	<a href="http://www.opiniononi.net">www.opiniononi.net</a>	2	1313	0.15	60,665,551	92,408	90

in a spatially meaningful way so that qualitative characteristics can also be considered. The findings of our research in terms of the spatial structure of the preferences for the Wadden coastal area are consistent with other previous studies showing that the islands are considered as highly attractive and significant places and landscapes (Baldacchino 2004, 2007; Clark 2004; Ratter and Gee 2012; Sijtsma et al. 2012; Daams and Sijtsma 2013; Stratford 2013). Comparing the mainland areas we can see that the landscape of the coastline of Lower Saxony is clearly much more appreciated than the coastline in Schleswig–Holstein (Fig. 8, right-hand side), and of the Netherlands and Denmark. This finding could be due to the closer distance of the isles to the mainland in the former of these regions, and may be related to the long and vivid history of seaside resorts along the German East Frisian Coast.

The Greenmapper value mapping tool ([www.greenmapper.org](http://www.greenmapper.org)) is a freeware software tool allowing for comparative research across other regions and landscapes, while in the meantime feeding an open-access scientific research database that accumulates increasing insights from shared data. Voll and Luthe (2014) explicitly address the challenge of effective long-term monitoring of protected areas. “Ideally this [monitoring] information should be collected in a consistent way over time, comparable with other sites and service providers so that benchmarking is possible. It needs to be easily and efficiently collected (...)” (p. 19). While value mapping is already quite widespread (Brown and Kyttä 2014), Brown and Fagerholm (2015) found little evidence of actual use of mapped ecosystem service data for decision support in land use planning and management. They connect this limitation to existing methodological pluralism and to scarce long-term case study-based research. We contend that using more standardised value mapping tools covering local to global levels in different regional

case studies and governance contexts may support their more effective application in guiding land use decisions (Sijtsma et al. 2013). The value of standardized landscape value mapping tool can be enhanced by building open-access databases.

#### Divergence in socio-ecological hotspot mapping

Alessa et al. (2008, p. 27) used so-called ‘socio-ecological hotspot mapping’ to research areas of ‘spatial representations of social and ecological’ convergence. We observed above that of all the markers placed in the broader Wadden coastal region, only 37% of them are within the protected UNESCO World Heritage limits. The Wadden UNESCO World Heritage designation is founded purely on the natural qualities of the landscape, and the area is therefore not labelled as a mixed cultural–natural UNESCO World Heritage site, as many other sites are. However, it is clear that, from the perspective of the community of fans that the attractiveness of the area is widespread, and exceeds the borders of the ecologically-protected area (Sijtsma et al. 2012; Hammer et al. 2015). To broaden the limits and extent of the designated landscapes limits would, we think, take in more cultural aspects. Therefore, a designation of both natural and cultural values might strengthen the Wadden Sea UNESCO World Heritage site and expand the number of objectives and disciplinary approaches that ought to be involved in its governance (Gordon 2012; Fassoulas et al. 2012).

#### Governance in the Wadden and the communities of fans

The governance situation for the Wadden Sea coastal area is complex, involving three countries, different regional units, multiple municipalities and parishes, as well as local inhabitants, economic actors and NGOs.



However, the noticeable omission of a social group which is entirely mis-represented in the governance debate is the community of (inter)national fans. These fans are, as we have seen, related to a wider-than-local scale, thereby reflecting the multi-scale complexity of governance frameworks (Cash et al. 2006). In this study they were larger than other actors; the number of fans was 14 million compared to, for instance, the local Wadden inhabitants, numbering only 1 million. If this is generally true, then planners and decision-makers need to actively connect to these (as yet) neglected stakeholders.

From a governance standpoint we have demonstrated that a wider and larger range of actors/stakeholders needs to be considered when decisions are being made in relation to both appreciated and designated landscapes (Vanclay 2012; Mehnen et al. 2013). We therefore advance the idea that, to consider fans' opinions relating to governance, may help them "become integrated as a partner in meeting the complex and overlapping objectives of designated landscapes and nature protection areas" (Voll and Luthe 2014, p. 17). How to link these other actors with local communities, and how to evaluate the types of influence they will have on the decision making process remain challenges for the future.

New software that connects people online with the aim of participating more actively in management and planning of their favourite landscapes, including their natural and cultural assets and values, can pave a novel way for citizens to become involved in democratic decision making and long-term funding for nature or landscape protection (Bijker et al. 2014). This should by necessity be developed through new online means if huge transaction costs are to be avoided (Barrett et al. 2001). We can conclude that, given the enormity of the potential fan audience and the often large physical distances between home locations of the community of fans and their favourite landscapes, the development of *online* communities for different areas and landscapes with cultural and natural values in order to improve governance processes is a logical path on which to embark.

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